INSTRUCTION MANUAL

MODEL T50-750

TRYLAB SERIES

TRYGON® ELECTRONICS, INC.

111 Pleasant Avenue
Roosevelt, New York 11575

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TABLE OF CONTENTS

SECTION		PAGE
1	DESCRIPTION	
	1.1 Introduction	1-1
	1.2 General Features	1-1
	1.3 Precautionary Measures	1-2
2	INSTALLATION AND OPERATION	
	2.1 Mechanical Installation	2-1
	2.2 Electrical Connections	2-1
	2.3 Operation	2-2
3	THEORY OF OPERATION	
	3.1 General	3-1
4	MAINTENANCE	
	4.1 General	4-1
	4.2 Loads and Interconnections	4-1
	4.3 Troubleshooting	4-1
5	PERFORMANCE TEST PROCEDURE	
	5.1 General	5-1
	5.2 Test Equipment Required	5-1
	5.3 Constant Voltage Test Procedure	5-1
	5.4 Constant Current Test Procedure	5-3

LIST OF TABLES

TABLE		PAGE
2-1	Front Panel Controls	2-2

LIST OF ILLUSTRATIONS

FIGURE		PAGE
2-1A	Set Up for Parallel Operation	2-4
2-1B	Set Up for Parallel Operation	2-4
2-2	Parallel Operation Connections	2-4
5-1	Constant Voltage Operation	5-2
5-2	Constant Current Operation	5-2

APPENDICES

List of Electrical Parts
Schematic Diagram

TABLE OF CONTENTS

SECTION		PAGE
1	DESCRIPTION	
	1.1 Introduction	1-1
	1.2 General Features	1-1
	1.3 Precautionary Measures	1-2
2	INSTALLATION AND OPERATION	
	2.1 Mechanical Installation	2-1
	2.2 Electrical Connections	2-1
	2.3 Operation	2-2
3	THEORY OF OPERATION	
	3.1 General	3-1
4	MAINTENANCE	
	4.1 General	4-1
	4.2 Loads and Interconnections	4-1
	4.3 Troubleshooting	4-1
5	PERFORMANCE TEST PROCEDURE	
	5.1 General	5-1
	5.2 Test Equipment Required	5-1
	5.3 Constant Voltage Test Procedure	5-1
	5.4 Constant Current Test Procedure	5-3

LIST OF TABLES

TABLE		PAGE
2-1	Front Panel Controls	2-2

LIST OF ILLUSTRATIONS

FIGURE		PAGE
2-1A	Set Up for Parallel Operation	2-4
2-1B	Set Up for Parallel Operation	2-4
2-2	Parallel Operation Connections	2-4
5-1	Constant Voltage Operation	5-2
5-2	Constant Current Operation	5-2

APPENDICES

List of Electrical Parts
Schematic Diagram

SECTION 1
DESCRIPTION

1.1 INTRODUCTION

The Trylab Series power supplies are flexible and dependable sources of DC power, which can be used to meet a variety of needs. These needs may range in scope from inspection and production testing, to laboratory bench testing and systems applications.

The wide range of outputs available makes these units well suited for use as basic laboratory power sources. The ability to provide power packaged in minimum space with high reliability meets the demands of most systems requirements.

All components used in the construction of the Trylab units are of the highest quality available, and have been subjected to 100% incoming inspection.

Each electrolytic filter capacitor is of computer grade, and has been quoted by the manufacturer as having a life expectancy exceeding ten (10) years. All silicon transistors have been "derated" and temperature aged to provide high reliability. All rectifiers are hermetically sealed silicon units, and all zener diodes have been temperature stabilized.

1.2 GENERAL FEATURES

The following terminals* and controls are located on the front panel: Output* - Sensing* - Voltage Adjust - Voltage Vernier - Current Adjust - Mode Switch - Meter Selector - Power - Voltage Range. Remote Programming terminals are mounted on the rear panel.

Constant Voltage Mode

A constant voltage is maintained across the output terminals at any preset value from zero to rated voltage output, provided that the load does not draw more than either the rated output current or more than the preset limiting current value determined by the front panel current adjust control. To operate the unit in the constant voltage mode, switch the regulator mode switch to the voltage position.

Constant Current Mode (T20-2 & T50-750)

Constant current operation is achieved by switching the regulator mode selector switch to the current position. In this position the current will be regulated within the maximum voltage and current limits of the supply.

Short Circuit Protection

A) T20-2 & T50-750

Short circuit protection is provided by the Automatic Current Limiting circuit which limits the maximum output current under all load conditions. The point at which automatic current limiting occurs is variable, and may be selected anywhere from 50 ma to the maximum rated current output of the unit. In the event of a short circuit, the output voltage will drop to zero, and will return to its previous level only upon removal of the short circuit.

B) T50-2

Model T50-2 utilizes "flip" short circuit protection. That is, when the current output of the supply exceeds the preset value, both voltage and current will drop down. In order to set the maximum output current, connect a resistor across the load, whose value is approximately 10 ohms with a 25 watt power rating. Set the current adjust to maximum position and vary the voltage adjust until the ammeter reads the required output current. Then slowly decrease the current adjust until the supply "flips". The current output may thus be adjusted anywhere between 400 ma and the rated output. In order to reset the supply, switch the off-on control to off and turn the supply on again.

Remote Programming (T20-2 & T50-750)

Remote Programming is provided in the voltage mode of operation, and may be utilized over the entire voltage range of the unit. The scale factor for Remote Voltage Programming is 50 ohms per volt.

1.3 PRECAUTIONARY MEASURES

Voltage Regulator and Inverter Inputs

Do not use voltage regulators or inverters as a primary power source. The outputs of these devices are usually not sinusoidal in nature, and if used as the AC source for the power supply, will cause serious loss of regulation of the power supply output. Capacitive input filtering used for semiconductor power supplies requires charging to the peak of the rectified AC wave which non-sinusoidal AC sources may not provide.

Systems Considerations

In systems applications it is recommended that each power supply input power line be run separately to the AC distribution box, in order to minimize cross coupling and interaction between equipment. Do not run sensitive signal leads such as the remote sensing leads in the same cable as the AC input without shielding. To keep the AC ripple in the output to a minimum, it is recommended that the AC input cables should not be run in close proximity to the output load cables.

Terminal Post Resistance

All terminals and shorting links serving Outputs, Sensing and Programming must be securely tightened before use. Serious loss of regulation and an increase in ripple can result due to a voltage drop caused by loose terminals and shorting links.

SECTION 2
INSTALLATION AND OPERATION

2.1 MECHANICAL INSTALLATION

General

The Trylab Series power supplies are normally provided in bench top cases. However, if the units are to be rack mounted, special rack mounting adapters must be used to secure the units to the relay racks. Single and dual rack panel adapters are available.

2.2 ELECTRICAL CONNECTIONS

Input, Power

A heavy duty 3 wire line cord and molded plug with grounding prong provides a path for input power to the unit.

The power handling ability of the AC power lines feeding AC power to the line cord must be considered, as serious losses in regulation and substantial increases in ripple can occur as a result of insufficient power handling capacity of these lines. The AC impedance from the breaker box to the power supply input connector should not exceed 0.75 ohms. All AC power line connections must be securely tightened, and any movable electric contact surface (such as the wiper arm of a variable transformer) should be kept clear of impedance producing oxide coatings.

Load Connections

(a) Local Sensing - Local sensing connections are made when rated regulation is not required directly at a remote load.

Connect the load to the output terminals marked + and -, and ascertain that jumpers are connected between the positive output and positive sensing terminals and the negative output and negative sensing terminals.

(b) Remote Sensing - Remote sensing connections should be used only when a single load is to be located some distance from the supply and the rated regulation must be maintained directly at the load.

Remove the jumpers between the positive output and positive sensing terminals and the negative output and negative sensing terminals. Using a twisted shielded pair of wires, connect the positive and negative sensing terminals to the load. To prevent damage to the power supply, correct polarity of both the remote sensing and output leads must be observed. The negative remote sensing lead and negative output lead must be connected to one side of the load, and the positive remote sensing lead and positive output lead connected to the other side of the load.

The shield should be grounded at the power supply end of the cable only.

Remote Programming (T20-2 & T50-750)

The power supply is shipped from the factory with a jumper across terminals 1 and 2 of the rear panel barrier strip. In this configuration the front panel voltage adjust controls provide adjustment of the output voltage over the specified adjustable range.

To adjust the output voltage from a remote location, remove the jumper from terminals 1 and 2 and connect it across terminals 2 and 3. Then connect the programming resistor between terminals 1 and 2.

It is also possible to remotely program the output current in the constant current mode. Plug an external potentiometer into the tip jacks on the front panel marked Current Adjust. Set the current control knob to Minimum Current and then adjust the external potentiometer for the desired output current.

TABLE 2-1 FRONT PANEL CONTROLS

Name	Function
AC ON	Toggle switch, controls input power.
VOLTAGE ADJUST	Potentiometer, adjusts voltage output.
VOLTAGE VERNIER	Potentiometer, adjusts voltage output.
CURRENT ADJUST	Potentiometer, adjusts current output.
*REGULATOR MODE SWITCH	Constant voltage, constant current mode selector switch.
METER SELECTOR SWITCH	Voltage indication, current indication selector switch.
VOLTAGE RANGE SWITCH	Provides two voltage indication ranges, 10 : 1 ratio.

* Model T20-2 & T50-750 only.

2.2 OPERATION

Control Settings

Set all front panel controls fully CW.

Shorting Links

If local sensing rather than remote sensing operation is desired, ascertain that shorting links are in place across the appropriate terminals.

Grounding

Either side of the output may be grounded, or the output may be used in a floating condition.

Power On

Connect the line cord to a nominal AC input power source. Set POWER switch S1 to AC-ON, and observe that pilot lamp DS1 glows.

Warm-Up

No warm-up time is necessary to place the unit into operation. However, a 30 minute warm-up period is recommended to reach rated stability.

Series Operation

To operate two or more power supplies in a series configuration, connect the output of each power supply in series. When operating in this mode, it is necessary to adjust the output of each unit independently. The output voltage is equal to the sum of the voltage settings of each power supply.

Parallel Operation

A) With rated resistive load connected across the output of power supply A as shown in Figure 2-1A, set VOLTAGE ADJUST control to desired output voltage and set CURRENT ADJUST control for maximum rated output current.

B) Connect power supply B as shown in Figure 2-1B. With no load across the output, set VOLTAGE ADJUST control for an output voltage 2 volts higher than the output voltage of power supply A. Place a short across the output terminals, and set the CURRENT ADJUST control for 1/2 the total load current requirement.

C) Remove all former output loads and connect the outputs of power supplies A and B in parallel with each other, an in parallel with the load, as shown in Figure 2-2.

D) If parallel operation of these two power supplies is desired for a systems application, it is important that both units be turned on simultaneously. It is therefore recommended that both power supplies be connected to a single large circuit breaker. Maximum output current will be twice that of either of the two power supplies, while minimum output current will be that of power supply B, or half the total load current.

voltage at either the negative sensing terminal or across the voltage adjust controls will appear as a voltage change in the collector of Q6.

This voltage change is amplified by Q5 and is used to regulate the Series Pass transistors via the Series Pass drivers.

SECTION 4
MAINTENANCE

> - W A R N I N G -
>
> High Voltages Are Present
> Use Caution

4.1 GENERAL

This power supply is a precision instrument. It is strongly recommended that only experienced troubleshooting personnel perform troubleshooting operations or attempt to repair the unit. If the power supply appears to be malfunctioning at all, the following procedure is recommended for isolating possible defects.

4.2 LOADS AND INTERCONNECTIONS

1. Disconnect all interconnections and loads to which the unit is normally connected.
2. Place jumpers between the positive output and positive sensing terminals, the negative output and negative sensing terminals and terminals 1 and 2 of rear panel barrier strip.
3. Connect a resistive dummy load across the output terminals. This load should be of sufficient value to allow the unit to operate at its maximum rated current and voltage output.
4. Apply nominal AC input power to the unit and check for normal operation. Satisfactory operation at this time would indicate that any malfunction previously encountered, is external in nature. All interconnections and loads normally used in conjunction with this power supply should then be carefully checked for electrical defects.

4.3 TROUBLESHOOTING

1. Set VOLTAGE ADJUST and VOLTAGE VERNIER controls fully CW. Using a 20,000 ohms per volt voltmeter or oscilloscope, check the voltages across the various circuit components as shown on the schematic diagram at the rear of this instruction manual. The sample voltages shown apply only if the unit is operating at its nominal AC input, and has a dummy load of sufficient size connected across its output to allow operation at maximum rated current and voltage output levels.

Any reading which is grossly incorrect indicates that the stage being tested or the one immediately preceding it, is defective. The Functional Diagram, Schematic Diagram and appropriate sections of the Theory of Operation will prove helpful in any trouble-shooting work. Proper polarity to be observed when testing can be easily obtained from the Schematic Diagram.

2. If voltage checks show no noticeable deviations from the prescribed values, disconnect AC power and proceed with point-to-point resistance checks across pots, switches, diodes, resistors, transistors, in that order.

3. When the trouble is of an intermittent nature such as poor regulation, ripple, etc., the use of an oscilloscope to determine dynamic changes will be necessary.

SECTION 5

PERFORMANCE TEST PROCEDURE

5.1 GENERAL

The following test procedure should be made whenever it is necessary to ascertain that the power supply is operating within rated specifications.

5.2 TEST EQUIPMENT REQUIRED (or equivalent)

(A) Differential VTVM, Fluke Model 825A
(B) AC VTVM, Hewlett Packard Model 400D
(C) Variable Auto Transformer, Powerstat Type 3PN136 (20 Ampere rating)

Shorting Link Application

For test purposes, jumpers should be connected across the positive output and positive sensing terminals, negative output and negative sensing terminals and terminal 1 and 2 on the rear panel barrier strip. To reduce pickup, shielded wire must be used for all connections between test equipment and the power supply being tested. To prevent ground loops, it is important that only one ground connection be made, as shown in Figure 5-1 and Figure 5-2. Tighten all terminal connections as securely as possible, and set all front panel controls fully CW.

5.3 CONSTANT VOLTAGE TEST PROCEDURE

A) Load Regulation

With the equipment connected as shown in Figure 5-1, connect a suitable load resistance across the output terminal connections. The load resistance selected must be able to dissipate the rated power of the unit (P = IE) and must be of sufficient value to yield the rated output current when the rated voltage is applied. Note the voltage indicated on the Differential VTVM. Disconnect the resistive load from the output. The maximum change in output DC voltage indicated on the Differential VTVM should not exceed by more than 0.05% or 15 mv (whichever is greater) that of the output voltage indicated with the load resistance applied across the output terminals.

B) Line Regulation

Place the resistive load across the output and note the voltage indicated on the Differential VTVM. Vary the AC input power 10% above and below the nominal AC input level. The maximum change in output voltage should not exceed by more than 0.05% or 15 mv (whichever is greater) that of the output voltage measured at either extreme of the AC input.

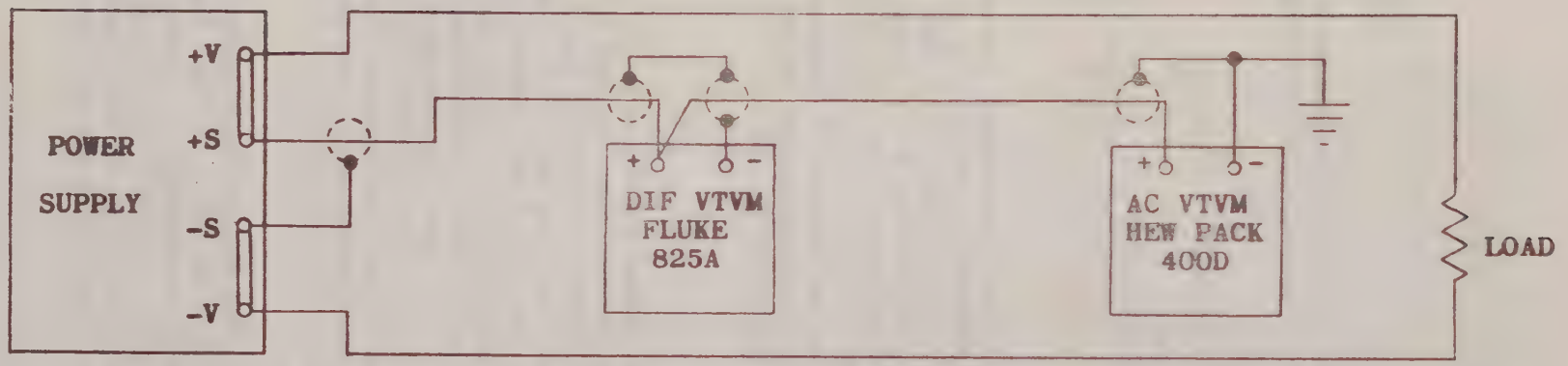

FIGURE 5-1
CONSTANT VOLTAGE OPERATION

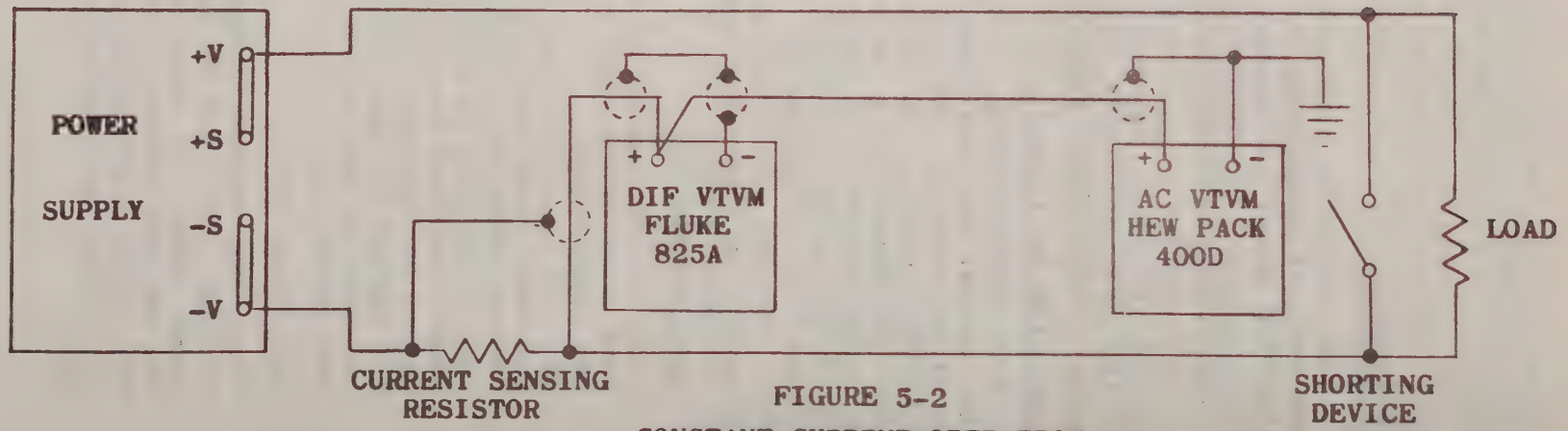

FIGURE 5-2
CONSTANT CURRENT OPERATION

C) Ripple Voltage

In order to reduce pickup, shielded test leads should be used in making ripple measurements. With the resistive load connected across the output terminals, measure the AC ripple with the AC VTVM. Vary the AC input power 10% above and below the nominal AC input level. The maximum ripple amplitude should not exceed 0.5 mv RMS.

5.4 CONSTANT CURRENT TEST PROCEDURE (T20-2 & T50-750)

A) Load Regulation

With the equipment turned off and the regulator mode selector switch in the current position, disconnect the resistive load from the output terminals. Connect a small current sensing resistor in series with the resistive load and then connect the load back across the output terminals. Selection of the proper value for the current sensing resistor may be easily made using the formula $R_S = \frac{1}{I_R}$ where R_S = Value of Current Sensing Resistor and I_R = Rated Load Current. Connect the equipment as shown in Figure 5-2, and apply power to the power supply.

Vary the VOLTAGE ADJUST controls and resistive output load as necessary, to achieve rated current and voltage output. Measure the voltage across the small sensing resistor. Compute and note the current flow through this resistor. Change the output load from the resistive load previously used, to a short. Again measure the voltage across the small sensing resistor and compute the value of the current flow through this resistor. The change in current should not exceed by more than 0.05% the rated current previously noted with a full resistive load across the output.

B) Line Regulation

Replace the resistive load across the output and measure the voltage drop across the small sensing resistor. Compute and note the current flow ($I = \frac{E}{R}$) through this resistor.

Vary the input line voltage 10% above and below its nominal value. Note the maximum change in voltage across the sensing resistor and compute the maximum current flow. The maximum change in current should not exceed by more than 0.05% the rated current previously noted at either extreme of the AC input.

C) Ripple Current

With the AC input line voltage adjusted to the nominal value of 115 volts and the resistive load connected across the output, measure the amplitude of the AC ripple as seen across the sensing resistor with the AC VTVM. Compute and note the current flow. Vary the AC input line voltage 10% above and below the nominal AC input voltage. Measure the maximum voltage drop and compute the maximum current flow. The maximum ripple current must not exceed by more than 0.01% or 250μa (whichever is greater) that of the current flow noted during nominal input line voltage.

Semi-conductors commonly used in Trygon power supplies are available for replacement or spare parts use under the following Trygon, commercial manufacturer, or JEDEC part number.

SEMI-CONDUCTOR PART NUMBERS

TRYGON OR MFR P/N	JEDEC EQUIVALENT
TR346	2N1556
TR360	2N360
TR361	2N652
TR375	2N1533
TR496	2N497A
TR505	1N536
TR656	2N656
TR1132	2N1132
TR1490	2N1490
TR1493	2N1490
TR1494	2N1490
TR1495	2N3442
TR1512	2N2138
TR1590	2N3054
TR1592	2N3054
TR1593	2N3441
TR1690	2N3440
TR2060	2N2060
TR2195	2N656
TR2620A	1N2620A
TR2905	2N2905

Semi-conductors commonly used in Trygon power supplies are available for replacement or spare parts use under the following Trygon, commercial manufacturer, or JEDEC part number.

SEMI-CONDUCTOR PART NUMBERS	
TRYGON OR MFR P/N	JEDEC EQUIVALENT
C35F	2N682
C50F	2N1910
E016	1N3938
E033	1N3940
G100B	1N4383
SC2	1N4383
SCR93-3	2N2575
SCR93-4	2N2576
SG1235	Replaced by G100B
SV515	1N821
UJ25	2N2647
16A507	2N2712
25H10	1N2129A
40108	1N1341

MANUFACTURER'S CODE LISTING - ELECTRICAL PARTS

1) The numbers designated in the SPARES column of the following ELECTRICAL PARTS LISTING indicate the recommended spare parts requirement for support of this equipment for a period of one year.
2) The code designations listed in the MFR column of the ELECTRICAL PARTS LISTING have been assigned to the following manufacturers:

CODE	MANUFACTURER	CODE	MANUFACTURER
A-B	ALLEN BRADLEY	LEE	LEECRAFT
ARN	ARNOLD	MILW	MILWAUKEE
BUSS	BUSS	MOTO	MOTOROLA
CARL	CARLING	PHAO	PHAOSTRON
CD	CORNELL DUBILIER	RCA	RADIO CORPORATION OF AMERICA
CLAR	CLAROSTAT	ROT	ROTRON
CORN	CORNISH	SAGE	SAGE
CTS	CHICAGO TELEPHONE SUPPLY	SANG	SANGAMO
ERIE	ERIE	SPRA	SPRAGUE
GE	GENERAL ELECTRIC	STEV	STEVENS
GI	GENERAL INSTRUMENTS	TRAN	TRANSITRON
HOYT	HOYT	TRY	TRYGON
IREC	INTERNATIONAL RECTIFIER CORP.	UNI	UNITRODE
IRES	INTERNATIONAL RESISTOR CORP.	WILG	WILGREEN
OHM	OHMITE	WL	WARD LEONARD
SCHW	SCHWEBER	SEMC	SEMCOR

SCHEMATIC DWG. NO. _____ REV. _____

FRONT PANEL DWG. NO. _____

CHASSIS DWG. NO. _____

LIST OF ELECTRICAL PARTS

PREP. BY HB CKD. BY _____

DATE _____ APPD. BY _____

LINE	REV	REFERENCE DESIGNATION	NO. REQ.	ASS'Y	DESCRIPTION	MFR.	MFRS. NO. OR SPEC. NO.	TRYGON DWG. NO.	RECOMMENDED SPARES
1		C1			CAP 500 MF 75 V	GE	43F1109CA3		1
2		C2,8			900 MF 85 V	SANG	539-2097-02		2
3		C3,11			.1 MF 400V	SPRA	160P10404		1
4		C4,6			35 MF 25V	"	40D356F025DD4		2
5		C5			.022 MF 400V	"	160P22304		1
6		C7			1 MF 150V	"	40D105F150DD4		1
7		C9			250 MF 6V	"	40D257F006DH4		1
8		C12			18 MF 100V	"	40D186F100DH4		1
9		C13			.0001 MF 1KV	CD	LA10T1S3		1
10									
11		CR1,2,3,4,19			DIODE	GE	1N538		4
12		CR5,6,7,8,10			"	TRAN	SG1235		8
13		11,15,18,20,22,23			"	"	"		
14		CR9,17,21			"	GE	TR505		2
15		CR12,16			" ZENER	TRAN	1N751		2
16		CR13			" "	"	SV515		1
17		CR14			"	"	SG22		1
18									
19		DS1			PILOT LIGHT	LEE	32R2111T		1
20									
21		F1			FUSE	BUSS	MDX 1.5		5
22		F2			"	"	AGC 1.5		5
23									
24		M1			METER 50 V 0.8	GE	DW91AFAFA2HN		1
25									
26		P1			CORD LINE	CORN	18 3		
27									
28		Q1,9			TRANSISTOR	MOTO	2N2138		2

REV. LET	DATE	BY	CKD.	REVISION	REV. LET	DATE	BY	CKD.	REVISION	REV. LET	DATE	BY	CKD.	REVISION

SCHEMATIC DWG. NO. _____ REV. _____

FRONT PANEL DWG. NO. _____

CHASSIS DWG. NO. _____

LIST OF ELECTRICAL PARTS

SHEET ___ OF ___

PREP. BY HB CKD. BY _____

DATE _____ APPD. BY _____

LINE	REV.	REFERENCE DESIGNATION	NO. REQ.	ASS'Y	DESCRIPTION	MFR.	MFRS. NO. OR SPEC NO.	TRYSON DWG. NO.	RECOMMENDED SPARES
1		Q2,3,4			TRANSISTOR	GE	TR361		3
2		Q5			"	"	16A507		1
3		Q6			"	"	TR360		1
4		Q7,8,10,11			"	MOTO	TR375		4
5									
6		R1			RES 270 2w 10%	IRES	BWH		1
7		R2			3.3K .5w 10%	AB	RC20		1
8		R3			100 3w 3%	SAGE	1300S		1
9		R4,9,15			2.2K .5w 10%	AB	RC20		2
10		R5			470 2w 10%	IRES	BWH		1
11		R6			150 .5w 10%	AB	RC20		1
12		R7,13,19			1K .5w 10%	"	"		2
13		R14			470 .5w 10%	"	"		1
14		R16			625 3w 3%	SAGE	1300S		1
15		R17,33			POT 150 1.5w 20%	CTS	B2533		2
16		R18,38			RES 4.5K 3w 3%	SAGE	1300S		2
17		R20			220 .5w 10%	AB	RC20		1
18		R21,22,23			340 25w	IRES	20TRM1		3
19		R24,25,27,28			.5 3w 10%	CLAR	CC30		4
20		R26			33 .5w 10%	AB	RC20		1
21		R29			47 .5w 10%	"	"		1
22		R30			5 10w 10%	IRES	13YAA		1
23		R31			49.92K .5w .5%	"	CECTO		1
24		R32			POT 75 4w 10%	CLAR	A1151		1
25		R34			RES 2.5K 3w 3%	SAGE	1300S		1
26		R35			POT 50 2w 10%	CLAR	B1153		1
27		R36			2.5K 4w 10%	"	A1152		1
28		R8			250 .5w 10%	IRES	CECTO		1

REV. LET	DATE	BY	CKD.	REVISION	REV. LET	DATE	BY	CKD.	REVISION	REV. LET	DATE	BY	CKD.	REVISION

SCHEMATIC DWG. NO. _____ REV. _____

FRONT PANEL DWG. NO. _____

CHASSIS DWG. NO. _____

LIST OF ELECTRICAL PARTS

PREP. BY LB CKD. BY _____

DATE _____ APPD. BY _____

LINE	REV	REFERENCE DESIGNATION	NO. REQ.	ASS'Y	DESCRIPTION	MFR.	MFRS. NO. OR SPEC NO	TRYGON Dwg. No.	RECOMMENDED SPARES
1		R 39			RES 49.92 K .5W 5%	IRES	CECTO		1
2		R 40, 41			100 .5W 10%	AB	RC20		1
3		R 10, 11			681 .5W 1%	IRES	CECTO		2
4		R 12			330 2W 10%	"	BWH		1
5									
6		S1			SWITCH DPST	CARL	2BK62 73		1
7		S2			" 3PDT	CARLING	HL 250-73		1
8		S3			" SLIDE	SMIT	516		1
9		S4			" SPDT	CARLING	2BB62-73		1
10									
11		T1			XFORMER ST50-750	TRY	B12L2B		1
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
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26									
27									
28									

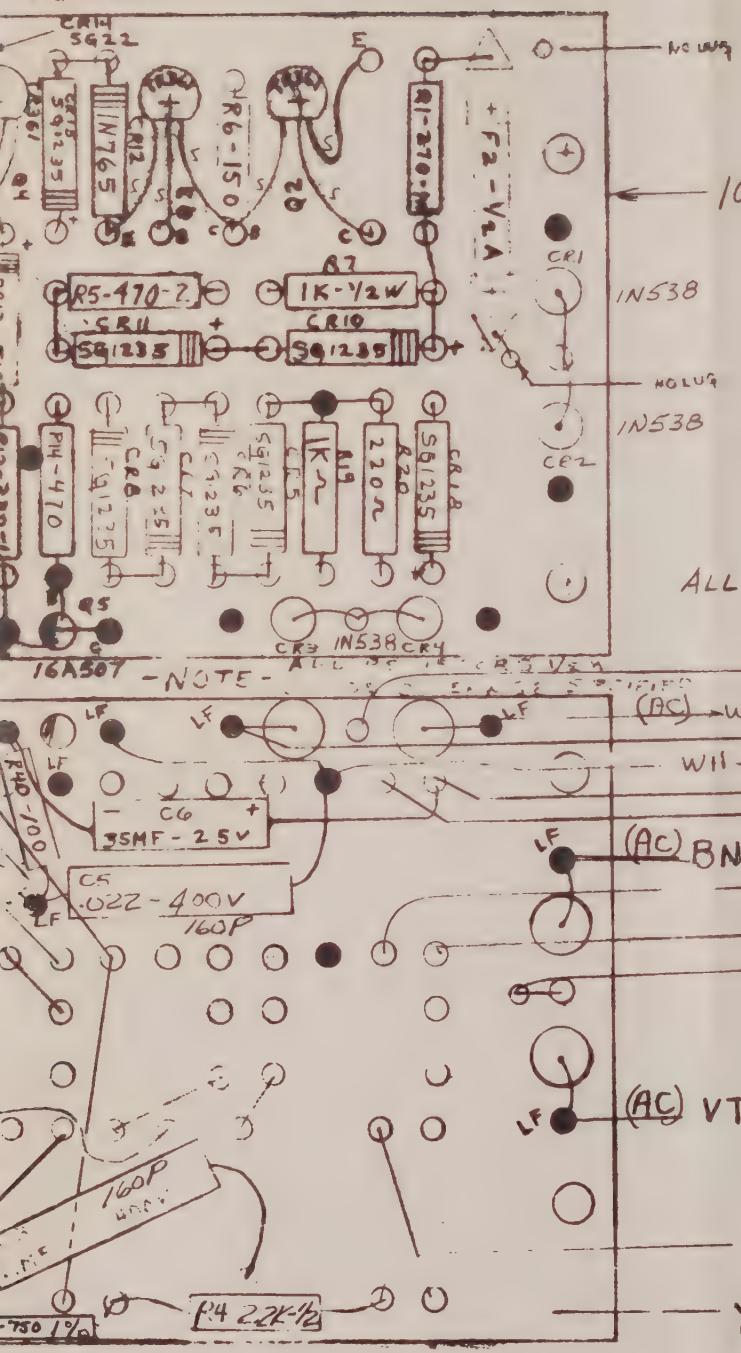
REV. LET	DATE	BY	CKD.	REVISION	REV. LET	DATE	BY	CKD.	REVISION	REV. LET	DATE	BY	CKD.	REVISION

RD-24
RD-82
GN-13
BL-23
WH-22
R15-2.2K
+ 35nF 25V

-75C

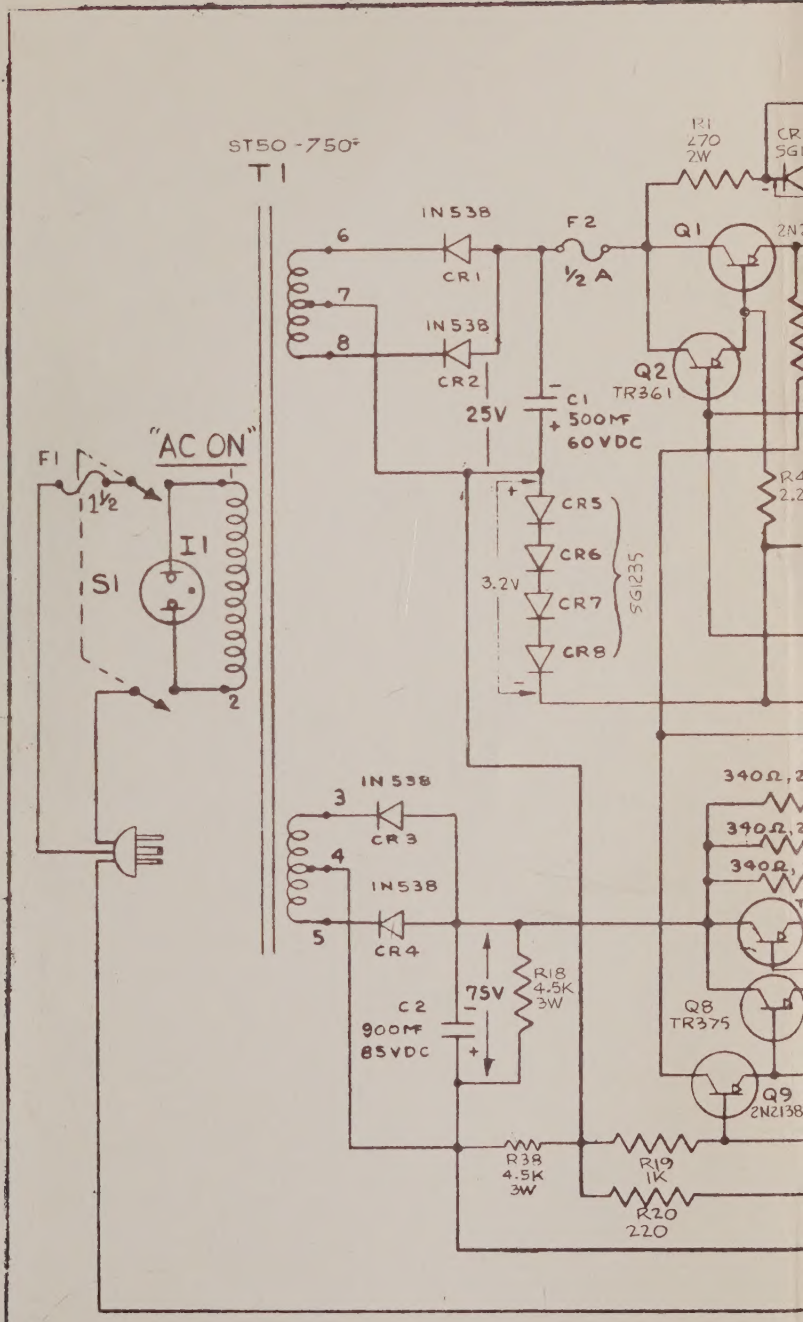
PD#

PD1922
REV. V



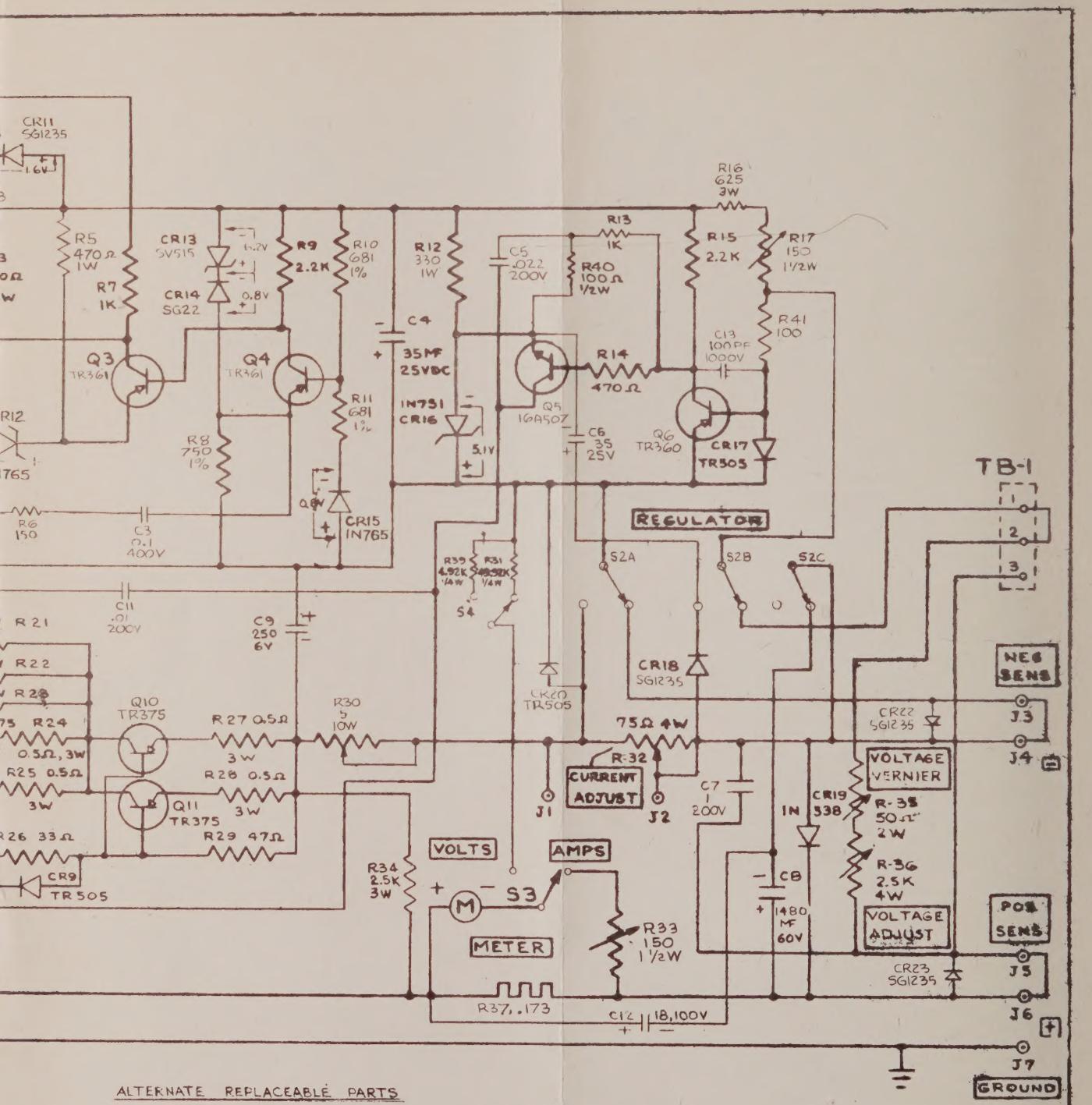
ALL JUMPERS #22

4-2-63



* NOTES:

1. ALL VALUES ARE IN OHMS, VOLTS AND MICROFA
   UNLESS OTHERWISE SPECIFIED.
2. RESISTORS ARE ½ WATT UNLESS OTHER
   SPECIFIED.
3. S-2 DRAWN IN [VOLTAGE] POSITION.



ALTERNATE REPLACEABLE PARTS

TR360	2N360
TR361	2N652
TR375	2N1533
16A507	2N2712
TR2148	2N388
G100B	IN816
SV515	IN821
G100B	TR505
G100B	SG22
G100B	SG1235
G100B	ST635
IN4383	IN538

ECN # 2975	TITLE
DRAWN B. Hance	POWER SUPPLY
CHECKED	T50 – 750
APPROVED	
APPROVAL DATE 10/13/60	
SCALE	WT

TRYGON ELECTRONICS
ROOSEVELT, NEW YORK

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